REMARKS

The Office Action dated November 26, 2003, was carefully reviewed. It is respectfully requested the Examiner reconsider the present application in light of the remarks herein.

The Examiner maintained the rejection of claims 1, 2, 3, 5, 9, 10, 12, 13, 14, 15, 17 and 20 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,285,251 to Dent et al. (hereinafter Dent). The Examiner referred to Figure 16 of Dent.

According to independent claims 1 and 14 of the present invention, the gains of each variable gain amplifier are controlled using an RF power detector in conjunction with a bipolar gain/phase slope controller. According to the present invention, each gain can be adjusted separately to produce a large range of linearization characteristics. The present invention allows for independent and dynamic programming of the gain and phase slopes through control voltages, which in turn allows a single part to be used in a variety of applications under differing conditions, and allows for better linearization in comparison to the Dent technique.

Referring again to the independent claims of the present invention, these claims require an RF power detector coupled to the RF input and receiving the RF input signal. The RF power detector generates an RF power signal corresponding to the power of the RF input signal. A controller coupled to the RF power detector receives the RF power signal, and includes control logic that adjusts the first and second gains of the first and second VGA's respectively.

The Dent reference teaches four amplifiers and four power supplies operating in conjunction with each other. Two of the amplifiers are being controlled by fixed power supplies and two of the amplifiers are being controlled by modulated power supplies. A controller modulates the first and second modulated voltage power supplies using modulation signals, while generating the first and second invert/noninvert control signals such that the combined first, second, third and fourth output signals into the load amplify the signal of varying amplitude.

Further Dent does not teach or disclose controlling the variable gain amplifiers based on a RF power signal that was generated by an RF detector and corresponds to the RF input signal as taught by the applicants of the present invention.

Dent requires four amplifiers, two fixed and two variable. The present invention discloses only two amplifiers. Both are variable gain amplifiers. According to the present invention, an RF power detector is coupled to the RF input and receives the RF signal input. The RF power detector generates an RF power signal corresponding to the power of the RF input signal. The controller is coupled to the RF power detector and has logic to adjust the first and second gains of the variable gain amplifiers that control the linearization response of the linearizer. The RF power detector is coupled to the RF input signal and detects the power of the incoming RF signal.

According to the present invention, increasing the gains of both VGAs equally as the power increases causes the overall gain to increase while the phase remains constant. By increasing the gain in one amplifier while reducing the gain in the other, the phase can be altered with constant amplitude. By controlling the I and Q signal

responses over input power variation, nearly any linearization characteristic is possible.

The Examiner is asserting that the controller 1660 disclosed in Dent is also an RF power detector. However, it is still respectfully asserted that Dent does not teach or disclose an RF power detector that generates an RF power signal corresponding to the RF input signal. Dent merely shows, in Figure 16, a controller 1660 that receives the I and Q components of a signal after it is fed through a splitter. Figure 16 of the Dent reference does not show an RF power detector that generates an RF power signal corresponding to an RF input signal as taught by the applicants of the present invention.

Figure 16 of the Dent reference is described beginning at line 53 of column 26 through line 33 of column 21, and the power of the RF signal is not mentioned therein. According to the teachings of Dent, the controller 1660 receives I and Q components of the input signal separately, but Dent does not teach or disclose that the RF power of the signal is detected, coupled to a gain/phase slope control element and used to adjust the gain of both VGAs as taught by the applicants in the present invention. The controller 1660 is described as modulating the first and second modulated voltage power supplies using modulation signals 1664a and 1664b which come directly from the controller, but it is not disclosed what these modulation signals are or where they are derived.

Therefore, it is respectfully requested the Examiner withdraw the rejection of claims under 35 U.S.C. § 102(e).

The Examiner rejected claims 4, 6, 11, 16, 18 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Dent in view of U.S. Patent No. 6,049,251 to Meyer. It is respectfully asserted that the claims currently pending in the application are patentable over the references cited by the Examiner.

The present invention is directed to the problem of non-variable linearizers that are heavy and have poor electrical performance. To overcome these drawbacks, the present invention proposes a linearizer having reduced size and mass, with improved electrical performance, that also offers the advantage of modifiable gain characteristics.

In order to accomplish these objectives, the present invention teaches a bipolar transistor-based linearizer with programmable gain and phase response. The bipolar transistor-based linearizer uses a splitter to separate incoming RF signals into two equal components; in-phase (I) and quadrature (Q). The I signal is amplified using a bipolar variable gain amplifier while the Q signal passes through a second VGA. After amplification, the signals are combined at the output using a summer to produce a pre-distorted signal that drives a traveling wave tube amplifier. The gains of the VGAs are controlled using an RF power detector in conjunction with a bipolar gain/phase slope controller. Each gain can be adjusted separately to produce a large range of linearization characteristics.

The Dent reference is directed to the problem of poor efficiency due to power dissipated as heat in prior art power amplifiers. Dent proposes an amplifier that is capable of amplifying a signal of varying amplitude. Dent teaches using four amplifiers and four power supplies. Two of the amplifiers have fixed power supplies,

and two of the amplifiers have modulated power supplies. The teachings of Dent are directed to the efficiency of the amplifier and are not directed to the size and weight of a linearizer. Therefore, one skilled in the art would not consider Dent a reference of interest in attempting to reduce the size and weight of a linearizer used to correct for gain compression and phase variation in traveling wave tube amplifiers and solid state power amplifiers as taught by the applicants of the present invention.

Furthermore, Dent teaches and discloses four amplifiers. Two of the amplifiers have variable gain. While the input signal has varying amplitude and the gain of two of the amplifiers is adjusted using modulated power supplies, the gains of the variable amplifiers in Dent are not adjustable as taught by the Applicants of the present invention. The Applicants teach the gain is adjusted based on a power signal generated by an RF power detector that corresponds to the incoming RF signal. The RF power of the input signal is detected, a power signal is generated and coupled to a phase/gain slope controller to adjust the gains of the variable gain amplifiers.

The Examiner suggested the Meyer reference discloses a variable gain amplifier with a gain controller having a common emitter amplifier and a plurality of bipolar devices. However, even if this reference were combined with the Dent reference, the combination would not result in the applicants' invention. Inserting the VGA disclosed in Meyer into the Dent reference would still require substantial modifications to meet the novelty of the Applicants' invention. For example, the issue of the RF power detector coupled to the RF input and the controller coupled to the RF power detector that is taught by the present invention still remains. In addition, the Dent reference requires four amplifiers and four power supplies. And furthermore,

the Dent reference does not teach varying the gain of the variable gain amplifiers using the RF detector in conjunction with the gain/phase slope control taught by the present invention.

It is respectfully requested the Examiner withdraw the rejection of claims under 35 U.S.C. § 103.

Should the Examiner have any questions or comments that may place this application in better condition for allowance, he is respectfully requested to call the undersigned attorney.

Respectfully submitted,

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